PROPOSAL

NATO/CCMS Pilot Study on

CLEAN PRODUCTS AND PROCESSES – PHASE II

TITLE: Clean Products and Processes – Phase II

1. Background to Proposed Study

The concept of sustainable development universally accepted as the means of protecting the environment for all mankind, demands that future manufacturing technologies must be cleaner, yet economically sound. The goal of sustainable development will, in the manufacturing sectors, be achieved by a combination of several methods. One method is improved housekeeping in process plants leading to large reductions of emissions and discharges of pollutants. Another method is significant modifications of existing process technologies through the application of sound science and advanced technologies. Yet another method is totally new process designs that are environmentally preferable, made possible by using tools for life cycle assessment (LCA) and environmental impacts. An effective pilot study will have far-reaching influence on future developments in NATO and the partnership countries, in fact throughout the world.. Such a pilot study needs to put together, for the benefit of all nations, exemplary developments in three important areas. First, we must address the issue of measuring cleanliness through devising environmental or sustainability indicators (called analytical tools or computer software). Second, we must examine cleaner techniques for achieving specific goals in selected industry sectors, such as power generation, textile, pulp and paper, leather tanning, metal finishing, and mining. Third, we must examine advanced techniques for cleaner product designs. Additionally an effective web-based dissemination method needs to be established to share the knowledge among academia, Government agencies, and industries of all nations.

Clean Products and Processes-Phase I was an attempt to lay the foundation of such an effective pilot study. This pilot first met in Cincinnati in 1998 with 13 members in attendance. The second, third, and the fourth annual meetings were held in Belfast, Northern Ireland, UK, Copenhagen, Denmark, and in Oviedo, Spain, respectively, while the membership increased to 27 currently. The fifth and concluding meeting of Phase I is scheduled to take place in May, 2002, in Vilnius, Lithuania.

Our initial goal of creating an effective forum for exchanging new ideas, knowledge, and methods for achieving cleaner products and processes has been achieved. The Phase I was launched at a time when the environmental impacts of industry and its products, and the depletion of natural resources were just beginning to be appreciated. Additionally, in the span of the last five years, only a few technology sectors could be examined. The need for keeping this forum alive for free exchange of ideas for continued sharing among the member nations, Phase

II is needed to conduct the unfinished business of dealing with the exploding developments in cleaner technologies and methods and to address some of the more important industry sectors.

Success Record of Phase I

The success and popularity of this Pilot study is evident in the gradual increase in the number of NATO and partnership countries joining in the last four years. An expression of support for Phase II study from the Pilot members is presented in the Appendix. Outside of Europe, even countries such as Japan, Israel, and Egypt have joined in this study. The number and nature of products and spin-off activities that this study has engendered is a clear sign of the impact the Pilot has achieved. Some of these products and spin-off effects can be listed:

- Several of the pollution prevention and assessment tools developed by the US EPA are made available through the EPA website, accessible through the NATO CCMS website. These tools are widely used among the Pilot member countries. Some of the more recently developed tools are in demand and will be made available soon.
- Phase I has completed one assessment of pollution prevention practices (and barriers to it) in member countries in textiles, and the report is available in the EPA website. Data for two other assessments on metal finishing and food/agricultural sectors have been collected from the CPP members and the reports are in preparation.
- Denmark has a successful collaboration with Solutia (USA) on industrial water use reduction and water recycling. The results have facilitated another collaboration between Denmark and Lithuania, and a third between Denmark and Poland is in planning.
- UK (Queen's University, Belfast) and USA (University of Arizona) have launched a collaboration in biofilm characterization and reduction for ultrapure water used in electronic industry.
- The concept of the establishment of NSF's Industry-University Cooperative research Center was discussed in the Pilot. Prof. Jim Swindall of the QUESTOR Center (Belfast) made a separate invited presentation in Israel. The establishment of these centers is being explored in several countries with help from this Pilot.
- Mrs. Teresa Mata (Portugal) acquired a Fullbright fellowship to work with US EPA in Cincinnati on cleaner design techniques as part fulfillment of her Ph.D. in chemical engineering from University of Porto.
- Several multi-country collaborative projects have just been formed involving such countries as Czech Republic, Israel, Turkey, Poland, Hungary, Denmark, Spain, Russia, Italy, Germany, Norway, Greece, Lithuania, and the USA. The industry sectors that have been targeted for cleaner practices are hospitals, industrial park management, use of membranes in milk, olive oil and chemicals, agricultural ecology, and sustainability indicators for benchmarking.

2. Purpose and Objectives of the Proposed Phase II of the Pilot Study

Now that the infrastructure for the Pilot study network has been established, we can use it to build a truly effective means of fostering collaboration among countries and facilitate dissemination of results pertaining to cleaner production. Phase II will continue on the course charted by Phase I with the special emphasis on the following items:

a. We will focus on exchanging and developing the best science to support the ideas of eco-efficiency and sustainability indicators. These yardsticks will be used in the near future throughout the world to identify technologies and products that are environmentally friendly. We want to use this Pilot to promote harmonization of the indicators for universal use.
b. We will focus on the state-of-the-art developments in several industrial sectors. These will be chosen from the sectors already identified by the members as most urgent.
c. We will construct a dissemination mechanism for the results of the pilot activities and related developments achieved elsewhere. Such comprehensive database would be very useful for those around the world in cleaner production standards. US EPA has already pledged to develop a web-based portal and link it to the NATO CCMS home page.
d. We will stimulate collaboration among the countries in solving common problems. To a great extent care will be taken to see that in each collaboration at least one partnership country is involved.

8. Estimated Duration

November 2002 (when the Phase I expires) to October 2007 (includes time for completion of the final report for Phase II).

9. Methodology and Scope of Work

The Phase II of the Pilot Study will be comprised of three areas. These are: (a) tools for assessment of pollution prevention, sustainability, and cleaner products and processes, (b) cleaner production methods in selected industry sectors, (c) electronic dissemination of cleaner production knowledge, products, and processes (with tutorials and examples).

a. **Decision tools**: Decision making tools for pollution prevention, sustainable practices, and product designs is a continuing focus. These tools are important because they integrate environmental solutions, life cycle concepts, process engineering, economics, product design methods, and new assessment and measurement methods. Most of these tools are computer-based and amenable to dissemination through the web. Particular concepts that underlie these tools are life cycle assessment (LCA), sustainability metrics, eco-efficiency indicators, process simulation and design, material substitution, and environmental impact assessment.
b. **Specific industry sectors**: The Pilot members have already identified the industry sectors of importance. In each year we will focus on one of these for in-depth discussion and assessment. The priority sectors are metal finishing, food/agricultural, pulp and paper, leather tanning, printing, and electronic industries.
c. **Information dissemination**: An electronic portal will be created by EPA, and linked to the NATO CCMS website. This portal will host reports of ongoing work of the Pilot, as well as by individual members. We will also use it to electronically discuss issues of importance. This method will be particularly useful in stimulating exchange of ideas in between annual meetings.

8. Non-NATO participation

This Pilot currently has several non-NATO members. Because clean products and processes is a global concern, we have opened it to other countries, such as Japan, and Israel and Egypt from the Mediterranean partnership zone. The current member nations are: Bulgaria, Canada, Czech Republic, Denmark, Egypt, Germany, France, Greece, Hungary, Israel, Italy, Japan, Lithuania, Moldova, Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovak Republic, Slovenia, Spain, Turkey, Ukraine, U.K., and the U.S.A.

9. Request for Pilot Study Phase II

It is requested of the Committee on the Challenges of Modern Society that they approve Phase II of Clean Products and Processes. The United States participation will comprise of US Environmental Protection Agency, National Science Foundation, and Department of Energy.

Pilot Country: United States of America

Lead Organization: United States Environmental Protection Agency
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7. Funding Support: US EPA will provide funding to enable a host country to defray a part of the cost incurred in holding the annual meeting. NATO CCMS provides support for the attendance of the partnership countries.

Appendix
Support of the representatives from member nations

Annik Magerholm Fet, Norway

NTNU represented by Professor Annik Magerholm Fet, has participated in the NATO CCMS Pilot Program since the Copenhagen meeting in May 2000. Environmental aspects and concern normally address people and companies across country boarders. To reach the goal of sustainable development, cooperation across country boarders is essential. Through the NATO CCMS Pilot Project contacts have been established, and new initiatives on cooperation has been developed. Among the results from our meetings, there is a new project under development between Norway and East European countries. The benefits in such cooperation go both ways; the experiences from Norwegian results from environmental work in industry and research is being transferred to East European countries. Similar, knowledge about the situation in those countries is important for the development of curricula and methodologies in Norway, and how to overcome barriers in the involvement of different industries. In addition to the establishment of new contact and networking, the topics presented at the meetings are in most cases very interesting.

Topics to be included in future meetings / Phase II

In the future meeting I believe that there should be a stronger focus on Eco-efficiency instead of Cleaner Production. Very often the meaning of the concept Cleaner Production is the same as Eco-efficiency, but the signals of using Eco-efficiency (and Industrial Ecology) is more proactive. Another topic is to focus on how to involve industry to avoid that the network only becomes of interest for the academia. The challenge is to get the ideas implemented in industry and leading companies. Another focus could be on corporate reporting of environmental performance (and further on may be on Corporate Social Responsibility – CSR and how to get companies committed to that), This could be a way to get industry more involved.

Michael Overcash, USA

I suggest we take a more focused effort than our current country reporting and host a day of science. Take 2 topics on cleaner production per meeting and ask everyone to report on specific aspects of that are underway in their country. In Oviedo, we sort of stumbled on this, as there were 6-7 talks on membranes. If we did this on a rotating set of topics then the representatives can do a bit more work and get the information from their country. This seems to have worked in the questionnaires I have sent out as these people consulted with others and submitted results. Then the host could focus (in part) on the same topic and maybe lead or summarize the various country responses and we can see if there is some interest in further work. Without critical mass of focus on a topic it is very hard to see the follow-on activities happening consistently.

Enrico Drioli, Italy

I am in favor of the applying for Phase II of our NATO CCMS Pilot Project on Clean Products and Processes. The work done during Phase I might greatly contribute to offer solutions to the problems related to Clean Products and Processes or more in general to sustainable growth. My suggestions, as already discussed, are on trying to focalize the future activities on a critical identification of real solutions to identified problems; a second recommendation is related to the implementation of mechanisms for the diffusion of the results of the work done and of the Phase II activities and results to the large public. An increase of the visibility of the results reached in the Pilot Project might be useful.

Teresa Mata, Portugal

I would like to express my interest in seeing the NATO CCMS Pilot Study on Clean Products and Processes go to phase II. As a Portuguese fellow, I had a lot of benefit in being associated with this pilot study.

The phase I was a great success. I learnt a lot with the exchange of ideas and experiences among the participants, through presentations, discussions and publications. I think we already captured the ideas to explore on the existing projects and on the proposed new ones. So, it would be of much interest to have the phase II of this pilot study.

Stefka Tepavitcharova, Bulgaria

The theme of clean products and processes stays in the base and is of special significance for a large number chemical industrial processes, environmental chemistry and agriculture. It is also of importance with respect to many problems of human health.

NATO CCMS Pilot Project, due to the mobility grants, promotes the mobility of scientists and experts from different world countries, working in the field of clean products and processes. The Pilot Project organizes regularly high level international scientific meetings, which enhance the knowledge of clean products, and processes, facilitate communication and exchange of scientific experience and ideas. The Pilot Project provides and disseminates the recent advances, excellence knowledge, updated information and results in the development of clean products and processes studies and their application to the solution of different problems. The scientists and experts have an opportunity to collaborate for transfer of knowledge and technologies, exploitation of research results, joint research for improvement the quality and sustainable environmental development. The meetings are especially important for the scientists and experts from Eastern European countries (Bulgaria is one of them) during the transitional period of their economies who often lack the necessary financial support for travel and attendance in such type forums.

<u>What new things should be focus on?</u>

The experience from the Phase I of the NATO CCMS Pilot Project on Clean Products and Processes shows it stimulates the exchange of information and experience.

In my opinion in Phase II much more efforts should be done also and for stimulation of co-operation in research and creation of networks with a view to future participation in joint projects under different NATO, EC and National RTD Programs for solving of common problems dealing with clean products and processes.

Horst Pohle, Federal Environmental Agency, Berlin

From the German point of view the information exchange on Programs, Methods and Instruments of Cleaner Products and Processes in different countries was very fruitful. Numerous suggestions were taken up and integrated to the own work. The focusing on the respective country, in that the meetings was executed was thereby of special importance. Germany is interested very much to resume the initiated transfer of technology in a phase II. In the phase II of the project however ways should be found, also between the meetings to improve information exchange between the representatives involved. This could contribute to improve the quality of the compiled results.

Jurgis Staniskis, Lithuania

As all nations move toward a true global economy and as demands for sustainable development grow, Lithuania is faced with the challenges of creating cleaner and economically sound manufacturing sectors. In this context, NATO / CCMS Pilot Study was interesting and useful because it created an international forum where current trends, developments and experience in the application of cleaner production and creation of cleaner products are discussed, debated and shared. No doubt, there is a need for the second phase, where clean products and processes could be discussed in more systematic way in the context of ecological engineering and tools for the preventive environmental management.

George Gallios, Greece

I am very pleased that I had the chance to participate in the Phase I of the NATO CCMS Pilot Study "Clean Products and Processes" as the Greek representative. I believe that this Study was very valuable for me and opened up new research horizons. During the meetings of the committee (all excellently Organized) I have learned a lot. I met people from many different countries (27 in last meeting) and discussed with them environmental problems, tools and methods for their solution. In order to collect information for the Study I made new contacts in Greece and learned a lot on the environmental effects of the Greek industries and measures taken (or planned) to resolve them. I hope that the Study will continue in Phase II and I 'll have the chance to participate in it.

The topics covered by the study were all very interesting and well selected. An important topic for Greece is the small olive oil producing factories that have a significant environmental effect. Maybe it could be included as the subject of a study for proposing cleaner methods economically viable for small factories. Another topic that could be covered is the use of simulation modeling in pollution prevention.

Viorel Harceag, Romania

In all countries on the world there is a great deal of interest in Sustainable Development and numerous efforts to achieve it, but important barriers remain, mainly in technical, economic, regulatory, legal, informational, and organizational categories. On the global level, Sustainable

Development still remains a very complex matter. There are rich (developed) and poor (developing) countries, having different capacity to act in this field. Waste disposal (which has become a regional or global problem as regulations, rising costs, and public opposition has forced industries and government officials in the rich countries to search for more distant places to dispose of wastes) is an good example of an issue involving these complexities. The poorer countries of the world have become suppliers of raw materials to the rest of the world, and also the recipients of wastes produced in wealthier countries. Pollution prevention (P2) is a well-developed field of environmental management that focuses particularly on the design of industrial processes within plants, leading to development of many strategies, assessment methods and a wide range of "clean technologies" that often improve both environmental and economic performance. This reason makes P2 a very important tool for economical development of the poor countries, an opportunity for East European countries to cross the transition period.

The NATO/CCMS Pilot Study on Clean Products and Processes help us, the developing countries representatives to meet the developed countries ones, to learn the simplest ways to manage industrial processes, to develop clean processes and technologies, to pass over the existing barriers in Sustainable Development in our countries.

Susette Dias, Portugal

The Portuguese participation in the pilot study "Clean Products and Processes" has been an excellent means of discussion of the best approach to clean technology dissemination and implementation being the diversity of the reported experiences a very powerful tool. As the number of participating countries increased there is no doubt that w can learn more from each other and simultaneously help our countries into the accomplishment of the environmental challenges of the next decades.

I think we could focus on the evaluation of the priorities for each country taking into account the need of best industrial practices but a survey of the remediation or treatment technologies in use and their impact in each country should also be analyzed. Dissemination strategies for conclusions should also be discussed.

Henrik Wenzel, Denmark

The first phase of the pilot study has proven highly valuable at all levels: to Denmark, to our Technical University of Denmark and to my own professional activities. The pilot has catalyzed and initiated many activities and bilateral co-operation projects. Some concrete examples are:

- Co-operation on Life Cycle Assessment (LCA) with the QUESTOR Centre at Queens University in Belfast including mutual visits and seminars
- Co-operation on LCA with TUBITAK, Marmara research centre in Turkey including a 9 month post doc educational professorship at the Technical University of Denmark for one of their co-workers
- Co-operation on LCA with North Carolina State University on LCA databases.
- Co-operation on Process Integration with the company Solutia Ltd in USA including a 1 month guest professorship at the Technical University of Denmark, establishment and

conduction of a PhD course, an internal course for the Danish Centre for Industrial Water Management. One further spin-off from this has been the establishment of an undergraduate course at the Technical University of Denmark on tools for industry's environmental work.

- Co-operation on Cleaner Production with the Cleaner Production Centre in Kaunas, Lithuania in a joint project on improving environmental performance in Lithuanian paper industry, and least but not last
- Hosting the pilot study meeting in Copenhagen 2000 and having there the opportunity to expose and receive valuable feedback on the Danish initiatives on Clean Products and Processes for Danish environmental authorities, companies and academia.

These activities are all a direct spin-off from the pilot study. The first phase of the pilot has, thus, given very substantial input to activities on Clean Products and Processes in Denmark and in our co-operation with other NATO and CP countries. Due to the network established by the pilot study, the spin-off activities are steadily increasing as the network is undergoing a consolidation. One example is that we will aim at establishing a university-industry co-operative research center in Denmark similar to the ones established at Queens University in Belfast, UK. This will take in depth co-operation between Queens University and the Technical University of Denmark over the next year or two.

I therefore, strongly support the continuation of the pilot study in a second phase. A suggestion for a focus area is that we take the opportunity to elaborate further concrete possibilities of support and technology transfer to Eastern European economies in transition.

Aysel Atimtay, Turkey

I am sure that you have received many opinions from the other participants. Nevertheless, I fully support your application for the second Phase and I am sure that with participation of several countries in the project it is going to be a successful one.

Andrzej Doniec, Poland

1. I am convinced the NATO CCMS Pilot Project should be continued as a Phase II. There are two reasons of that: a. Such a type of activity serves as a primary source of information exchange on a very broad set of problems related to cleaner industrial processes and products in the technical aspect as well as managing one. These, in conjunction with very specific state-of-the-art technical novelties delivered by excellent experts, have stimulating effect within participants transferring the experience (knowledge) to their countries, universities, institutes etc. Personal contacts are also of great importance.
2. In the planed Phase II each of presented and discussed topic should refer to (be composed in) more general one e.g. industrial ecology or industrial symbiosis. Some sort of cooperation e.g. joint (with UNIDO?) projects would also be nice. These are my thoughts. Maybe you will find them useful.

G.G. Kagramanov, Russia

To my mind this Pilot, i. e. Phase I as well as Phase II, is very interesting to me end during our discussions in Oviedo I realized how really works the scientific cooperation in my field of interests.

It seems to me that the ideas we discussed in Oviedo are very fruitful ones. So the current focus is O. K. I should like to emphasize the critical role of membrane technologies in clean processes.